

Letter from W. H. Burr to Charles J. Bell, March 30, 1906, with transcript

William H. Burr, Consulting Engineer, Broadway & 117th Street. COPY. New York, N. Y., March 30, 1906. Mr. Charles J. Bell, President of American Security & Trust Co., Washington, D. C. Dear Sir:—

While in Washington Thursday, March 22nd, I made a careful examination of the various models illustrating a number of applications of the Tetrahedral system of construction covered by the patents of Dr. Alexander Graham Bell, some of which were of iron or steel adapted to the sustaining of heavy loads, while others were of aluminum or wood adapted especially to the purposes of his investigations in Aero-physics. I also read with care the patents under which the applications of Tetrahedral bracing have been made. In accordance with the instructions of yourself and Dr. Bell, as I understand them, my attention was given, as far as the matters covered by this report are concerned, wholly to the application of the system of bracing under consideration to the construction of bridges and buildings and other similar fields of engineering structural work.

The fundamental element in the Tetrahedral system of bracing is the triangle, the shape of which cannot be changed without changing the length of some one or more of its sides. The triangle is also the fundamental element of all bridge trussing for the same reason. This general fact or principle accounts for the 2 remarkable stiffness and strength of the Tetrahedral models which I examined and which may be formed in almost unnumerable shapes by a suitable combination of Tetrahedral frames. The construction embodies the elements of stiffness and strength in a most complete and satisfactory manner.

Since the examination of the models and the data submitted to me I have given most careful consideration to the matter of the useful application of the Tetrahedral system to engineering structures in connection with the views expressed by Dr. Bell. I regret that

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your illness prevented my receiving from you also any suggestions or observations which you might have desired to make.

It is my judgment that the Tetrahedral system of bracing or construction cannot be profitably applied to the construction of heavy bridges such as those required for railroad purposes and for the heavier classes of highway bridge work. The system of ordinary bridge construction has been brought to a state of remarkable excellence after many years of study and experience by engineers expert in that field of construction, and I do not believe that the application of the Tetrahedral system would be found to have any advantage over the present admirable system of distribution of metal to meet the stresses developed under railway and other heavy moving loads. Members of very large section would be required involving corresponding difficulties in the development or satisfactory details of great strength. While unquestionably satisfactory designs could be attained it is open to grave doubt whether there would be any resulting advantage over the present system of bridge building; indeed, it is my opinion that there certainly would be none.

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On the other hand it is my strong opinion that under proper business management the system of Tetrahedral bracing may be usefully and profitably applied in a wide range of lighter construction. It is my judgment that a particularly favorable field of application of this system of bracing may be found in reinforced concrete construction which is coming rapidly into use for arch bridges and building construction. I believe that under proper development reinforced concrete floor beams and columns for buildings could be most advantageously constructed by using Tetrahedral steel bracing for the reinforcing portion of those members. It is obvious that in the few days that have elapsed since the matter was called to my attention the details of this application of the system cannot be elaborated to any great extent, but as I reflect upon the subject it seems to me that this field of reinforced concrete construction is particularly adapted to the application of Dr. Bell's system of bracing.

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It also seems to me that there may be a wide range of application to this system of bracing in steel in lighter structures such as foot bridges and certain highway bridges either as stiffened arches or stiffened suspension bridges of comparatively short span and in some other special constructions where lightness and stiffness are essential elements. There are forms of light construction like towers for sustaining tanks in small waterworks systems, and in other similar work where it seems to me that the Tetrahedral bracing might find economical and useful applications, although at this early stage in the matter I am not prepared to specify in much detail.

The business success of developing this system of construction in those various lines where it would find useful application would depend much upon a proper design of the connections and other details so as to bring them to standards of a simple and economical character as far as possible. The greater the duplication of parts after a suitable distribution of the material in main members is attained the greater will be the resulting economy in construction. The system seems to me well adapted to the attainment of those ends. It would obviously be necessary to devise different forms of cross-section for the main members for a wide range of uses or applications and certain standards could be devised and adopted which would enhance greatly structural economy.

To sum up the matter as concisely as possibly it does not seem to me that the Tetrahedral system of bracing is adapted to heavy bridge work, but I am strongly of opinion that there is a wide range of highly useful and economical application in the various directions which I have indicated, and that others may be found under judicious design and energetic business administration.

I shall be glad to give any further information or arrange for a further conference should you desire it.

Very truly yours, (signed) W. H. Burr. Consulting Engineer.